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Using FEAST to characterize the farming and livestock production systems and the potential to enhance livestock productivity through improved feeding in Bekafa, Doyogena District, Southern Ethiopia

A. Mekonnen[1], S. Mengistu[1], S. Woldi[1], T. Abiso[1] and J. Wamatu[2]

[1]Areka Agricultural Research Center
[2]International Center for Agricultural Research in the Dry Areas

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ICARDA
Box 5689, Addis Ababa, Ethiopia
Phone: +251-11-617-2281
Fax: +251-11-617 2001
E-mail: S.Silim@cgiar.org

ILRI
Box 5689, Addis Ababa, Ethiopia
Phone: +251 11 617 2000
Fax: +251 11 617 2001
Email: ILRI-Ethiopia@cgiar.org

Introduction

Livestock production plays a significant role in the livelihoods of households in rural areas of Ethiopia. However, its productivity is low with a low (18%) contribution to the national Gross Domestic Product. The poor performance of the livestock sector in the country has been related to different reasons such large livestock numbers, poor quality of breeds, insufficient amount of good quality feeds and seasonal variation in there availability, poor health of livestock and inadequate health services, inefficient management of livestock, poor infrastructure, poor marketing and credit facilities, inadequate knowledge of integrated mixed farming system and inability of the farmers to exploit this resource due to different priorities. Recent increases in livestock production have mainly been due to expansion of herds and not improvements in productivity. Among the aforementioned problems, feed scarcity is often cited as the primary constraint to livestock productivity in crop-livestock mixed farming systems. A sheep value chain assessment conducted by Areka Agricultural Research Center (ARC) and ICARDA in Doyogena district also indicates insufficient feed supply as a major bottleneck for livestock production in the area. Thus, tackling this problem through proper and strategic intervention is expected to bring certain improvement to livestock productivity.

The Feed Assessment Tool (FEAST) is a systematic method to assess local feed resource availability and use. It offers a systematic and rapid methodology to assess feed resources at site level with a view to developing a site-specific intervention strategy to improve and optimize feed supply, utilization and animal production through technical or organizational interventions. FEAST differs from conventional feed assessment approaches that focus on the feeds, their nutritive value, and ways to improve it. FEAST broadens this assessment to account for the importance of livestock in local livelihoods, the relative importance of feed problems locally, and the local situation related to labour, input availability, credit, seasonality, and markets. This tool was used to characterize the farming and livestock production system including feed resources and related aspect of small holder farmers in Doyogena district of Kembata-Tembaro zone in Southern Ethiopia.

The feed assessment study was conducted on 30 – 31st December 2013 by researchers from Areka Agricultural Research Center with backstopping from International Center for Agricultural Research in the Dry Areas (ICARDA).

The objective of the study was to provide an overview of farming system and identify the major livestock production challenges, opportunities and possible potential interventions with special emphasis on livestock feed and related aspects for the improvement of livestock production and productivity in the target district.

Study site

Doyogena district is located in Kembata-Tembaro zone, a distance of 258 km to the South-West of Addis Ababa on an altitude ranging from 1900 to 2748 meter above sea level (m.a.s.l). It comprises of 14 sub-districts and has a total of 17,263.59 hectares of area coverage. Cultivation of crops comprises 86% of the area, forest and bushes 11.8%, 2% grazing land, and 0.2% is degraded land. The district has two major agro-ecologies, Dega (70%) and Woyina dega (30%). It has a minimum and maximum temperature of 10°C and 16°C respectively and receives average annual rainfall of 1400

mm. The district boarders Kacha Birra district on the south, Hadiya zone on the west and north and Angecha district on the east.

Doyogena is one of the major mandate research areas of Areka ARC and intervention area for ICARDA through the community based sheep breed improvement program. Currently, three different projects such as large ruminant synchronization, community based sheep breed improvement and regional watershed projects are being undertaken by Southern Agricultural Research Institute in the district through collaboration of different research and development stakeholders. Human and livestock population of the district has been listed in the appendix part. The maximum, average and minimum land holding per household in the district is 3.5 ha, 0.75 ha and 0.25 ha, respectively. The major crops produced in the area include enset, wheat, potato and faba bean.

Bekafa *kebele* (peasant association) where the study was undertaken is located at a distance of 7 km from Doyogena town on the way to Hosana (about 1 km on the right of the main road). It has an area of 1320 hectares with woyina dega agro-cology.

Sampling method

After discussions made with livestock experts and work process leaders from the *woreda* (district) office of agriculture about the objective of the study and farmers selection criteria (representing the whole kebele and all social groups, consider participation of females and those who participate on livestock rising), nineteen farmers (4 females and 15 males) from Bekafa *kebele* were selected by *kebele* development agents based on the guidance given by the woreda experts.

Survey structure and format

A focus group discussion using participatory rural appraisal and individual interview was conducted to collect necessary data for the study. All selected farmers were allowed to participate in the PRA group discussion so as to capture important information about the whole *kebele*. Information on general farming, livestock production and management system and the problems and opportunities for livestock production was collected from the PRA group discussion. After completing the PRA group discussion, nine farmers from three different land holding classes (small, medium, and large - 3 farmers from each class of land holding size) were purposively selected from the group for the purpose of individual interview that focused on crops grown, income sources, feed availability and seasonality.

Data analysis

Narrative reports collected from group discussion were examined and reported. Individual interview results were analyzed using FEAST excel temple (www.ilri.org/feast).

Results

The farming system in Bekafa *kebele* is classified as an enset based mixed crop-livestock production system. Farm land size varies among the households. Depending on the land holding size, farmers in each *kebele* were classified into three classes such as small, medium and large where majority of farmers lie in the medium range of land holding. The average land holding in the study *kebele* is 0.5 hectare per household. There is a serious land shortage problem in the sub-district as a result of a high population density and thus farmers use a land for more than one crop per year. There is no fallowing practice with the aim of rehabilitation but small portions of cultivated land are reserved for the purpose of grazing. Land holding and family size classes for each *kebele* are indicated in Figure 1 and Table 1 below.

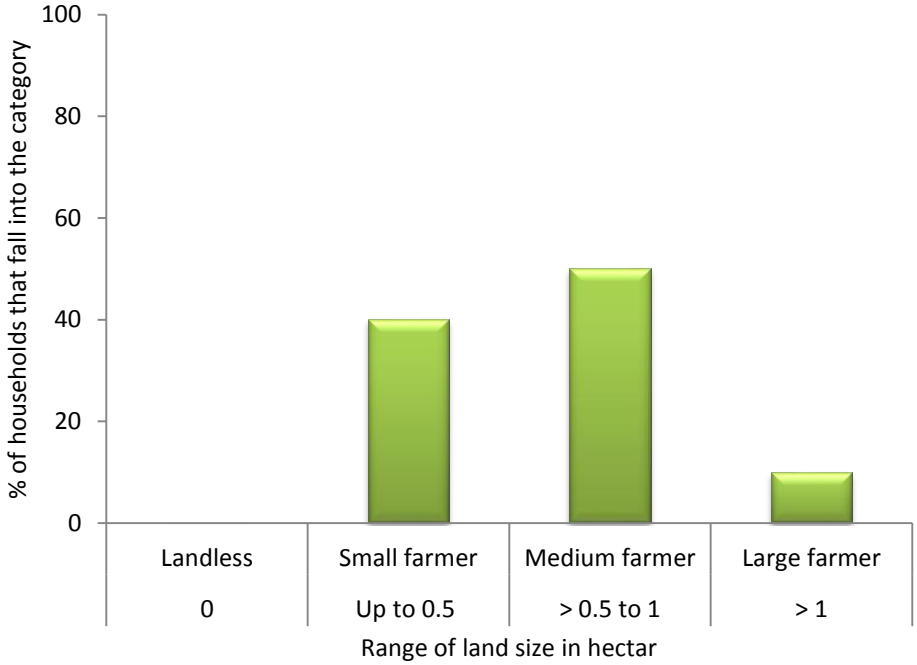


Figure 1: Proportion of farmers in different ranges of land size in Bekafa *kebele*

Table 1: Family size category in Bekafa *kebele*

Family size category	No. of persons per households
Small	2
Average (Medium)	8
Large	15

Farmers in the study *kebele* classified cropping seasons into two major seasons namely *Belg* and *Meher*. *Belg* season occurs from January to June, whereas *Meher* cropping season occurs from July to December. Activities in each cropping season include planting upto harvesting. The start of *Belg* season depends on the time of rain occurrence, and may start from February or March (if the rains come late). Majority of the farming activities are based on rainfall except very few farmers who use minor irrigation from hand-dug wells, water harvesting structures (which lasts for short period) and springs for vegetable production. With these water sources, 10 % of households use irrigation in

Bekafa *kebele*. The rainfall pattern over twelve months of the year 2013 was scored by the farmers. The score was given on a scale of 0-5, where 5 = excess, 4 = high, 3 = medium, 2 = low, 1 = very low and 0 = no rain. Table 2 shows that high rainfall occurs between June and October.

Table 2: Rainfall score given by farmers from Bekafa *kebele*

Kebele	Month											
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Bekafa	0	0	1	2	3	4	4	5	5	4	0	0

Labour shortage is not a critical problem with regard to the need for agricultural activity. Daily labourers on contract basis are employed by some farmers during critical harvesting time. Farmers pay 400 birr ($20) for a quarter hectare of land that has to be completed within two days by three persons. About 30 % of people leave the *kebele* for employment elsewhere and 1 % for education. Major crops grown in the study areas include wheat, barley, bean, pea, teff, maize, potato, cabbage, and enset. Wheat, enset and potato are the dominant food crops grown in Bekafa *kebele*.

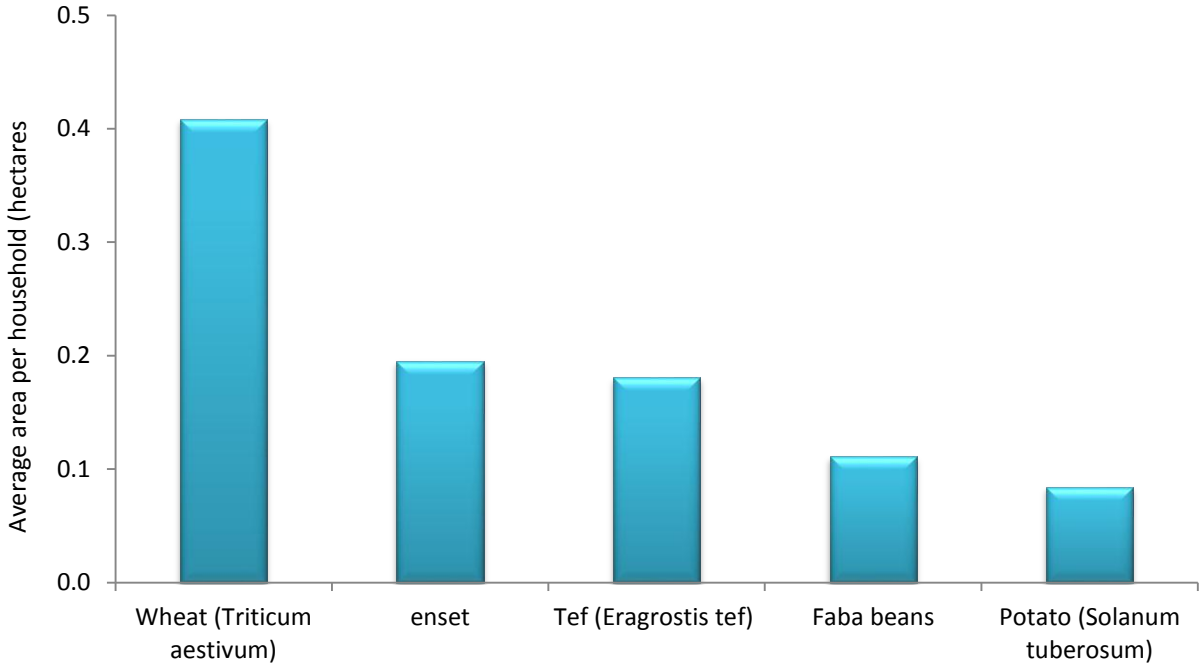


Figure 2: Major crops grown and average area (ha) per household in Bekafa *kebele*

Livestock production and management

Milk and meat production, egg production, cash source (from sale of animal and their products), source of manure and source of power for threshing and traction are the main purposes of keeping livestock. Different species of livestock are kept by farmers in the study areas. Livestock species kept by farmers are shown in Figure 3. Average numbers of a given species and % of households that own the species are indicated in Table 3.

Table 3: Uses of livestock species, percent of HH that own the species and average numbers of animals per household in Bekafa *kebele*

Livestock species	Bekafa *kebele*		
	Use	**% of HH that own the species**	**Average number of animal per household**
Local dairy cow	Milk, butter, cheese, calf crop for sale and manure	85	2
Improved dairy cow	Milk, butter, cheese, calf crop for sale and manure	10	1
Draught cattle	Traction, trashing and manure	60	1
Fattening cattle	Cash source, meat and manure	0	0
Sheep	Cash source, meat, manure,	40	2
Goats	Cash source, meat and manure	20	2
Poultry-Village	Egg, meat, cash source	95	4
Horse	Transportation and trashing	15	1
Donkey	Transportation and trashing	70	1
Mule	Transportation	1	1

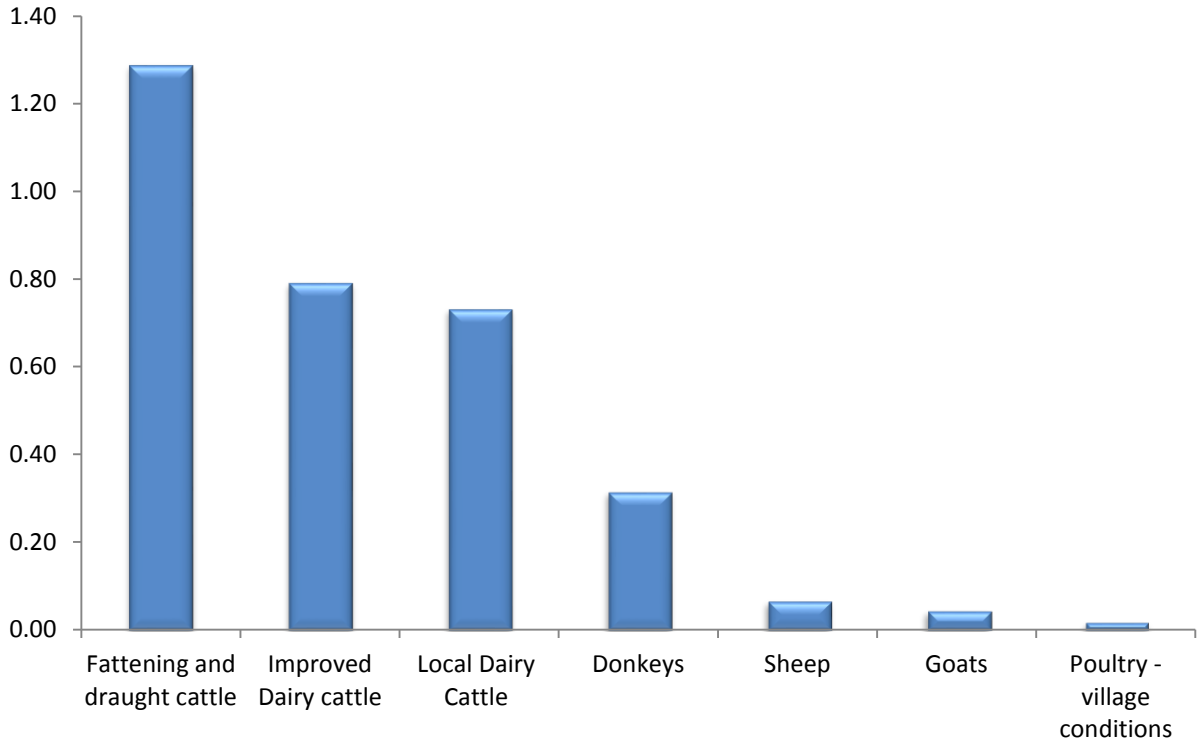


Figure 3: Average livestock species holdings per household in Tropical Livestock Unit (TLU) in Bekafa *kebele*

More than half of households in Bekafa *kebele* do not own small ruminants mainly because of shortage of grazing land to rear these species.

Farmers pointed out that they face financial constraints resulting in inability to fulfill input and material requirements for improved crop and livestock production. They indicated that there is a credit company called Omo Micro Finance. The stringent rules and regulations (e.g. one needs first to save money in the institute in order to get credit) and limited capacity of the service (small amount of credit - equivalent to the amount saved) are major obstacles for credit amounts desired by farmers. Agricultural inputs and materials related to livestock production are not readily available for the farmers.

Farmers sale crop products, livestock and their products and services to get income. The contribution of different income sources in the *kebele* have been indicated in Figure 4 below. Food crops (wheat, enset, potato), small ruminant fattening and dairying are the first, second and third important income source respectively in Bekafa *kebele*.

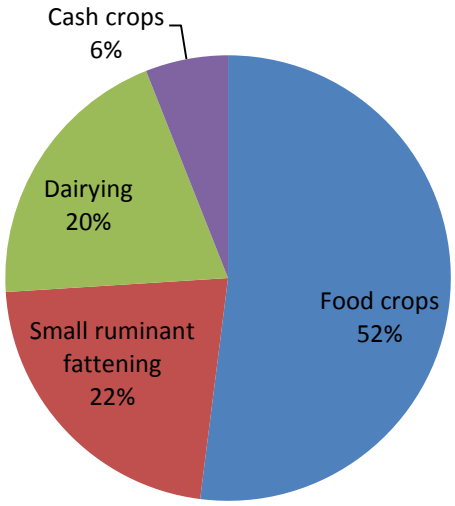


Figure 6: Contribution of livelihood activities to household income (as a percentage) in Bekafa kebele

Management of livestock species

Only about 10% of households in the *kebele* have separate houses for livestock. Most livestock are housed in separate partitions within dwelling houses. Awareness problems, fear of theft and predator risk and material shortage were some of the reason that farmers mention not to have proper separate livestock houses.

Style of feeding varies depending on season. Combination of stall feeding and tethering are common during cropping season when most farm lands are covered by food crops. There is also a practice of open grazing during dry period after crop harvest. Major feed sources include crop residues (cereal and legume straw), natural grass (fresh cut), enset (leaf, pseudo-stem and root part), cultivated fodder (limited oats and maize), improved planted grass (desho), grazing, different natural browses and purchased feed (wheat bran). Farmers are accustomed to mixing straw with bran, bole, and water to feed lactating dairy cow and fattening oxen.

Feed shortage is one of the major impediments for improved livestock production. Availability and quality of feeds varies along different seasons. **As a coping mechanism, f**armers use purchased feeds (bran, maize fodder, grass – Figure 7), enset (both residues and that used for human food), allocate part of cultivated land for the purpose of grazing, cultivating forages (desho grass), collect naturally occurring fodders and properly collect and conserve crop residues (straw).

Farmers in Bekafa *kebele* cultivated oats (Avena sativa) previously. However, currently, there is limited or no oats production in the *kebele* due to shortage of land and fear of post-harvest effects of oats as it becomes a weed for the other food crops.

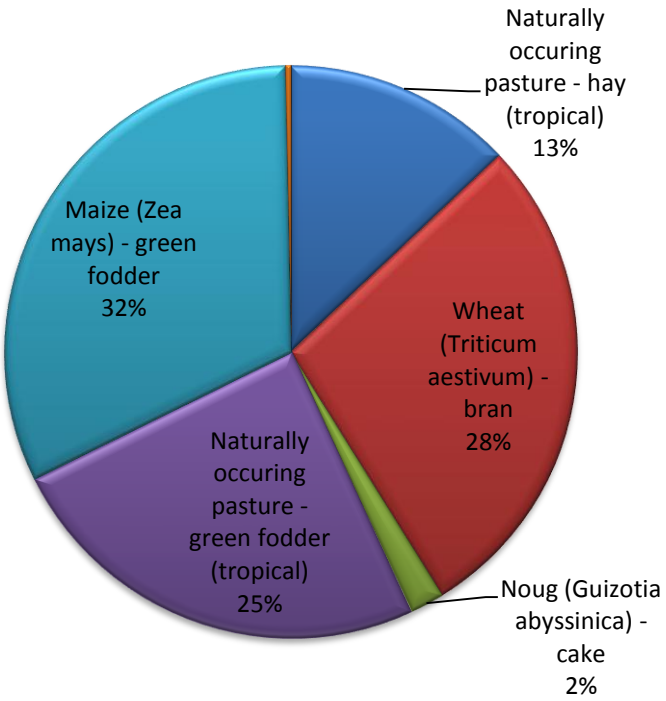
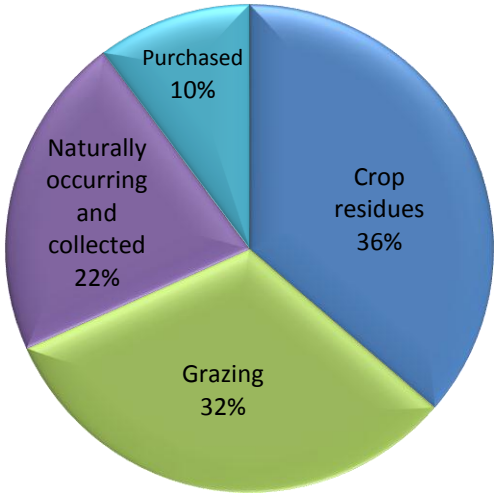
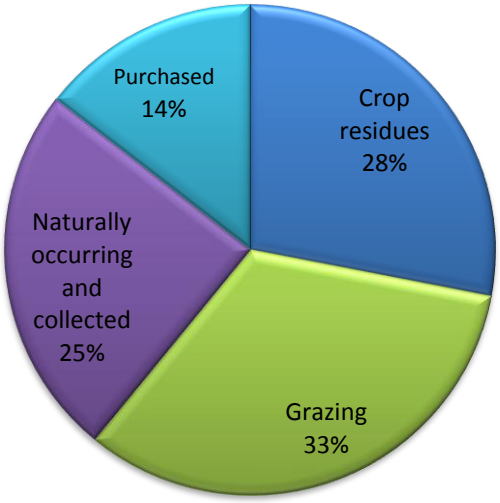


Figure 7: Quantity of feed purchased over a 12 months period in Bekafa kebele

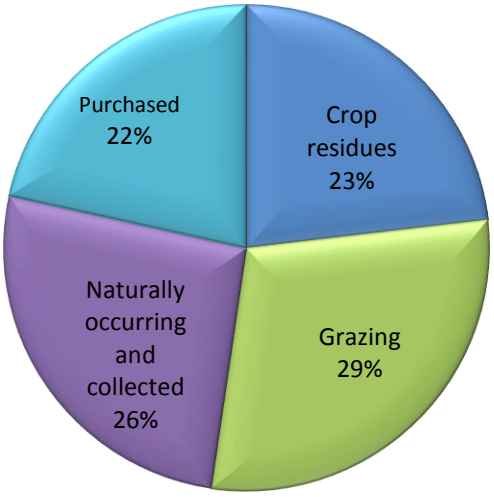
Besides the shortage of feed supply, quality problem is also a critical challenge for improved productivity of livestock. Livestock in the area depends on the existing poor quality feed sources to satisfy their dry matter (DM), metabolizable energy (ME) and crude protein (CP) requirements. Dietary contribution of each feed sources in the two areas have been indicated in Figure 8 below. Crop residue, cultivated fodder and grazing are the main source of dry matter content of the total diet. Metabolizable energy (ME) content of the total diet is also obtained from these feed sources.



a. Dry matter content of total diet



b. Metabolizable content of total diet



c. Crude protein content of total diet

Figure 8: Dietary compositions of the total diet of feeds in Bekafa *kebele*

In Bekafa kebele, crop residues and grazing provides major dry matter (DM) and metabolizable (ME) content of total diet. Naturally occurring and collected fodder is a main contributor of crude protein (CP) content of the total diet.

The composition of the livestock diet in relation to the rainfall pattern is shown in Figure 9. Most of the feed resources are available throughout the year in various proportions with the exception of green fodder that is available during the higher rainfall periods June to October.

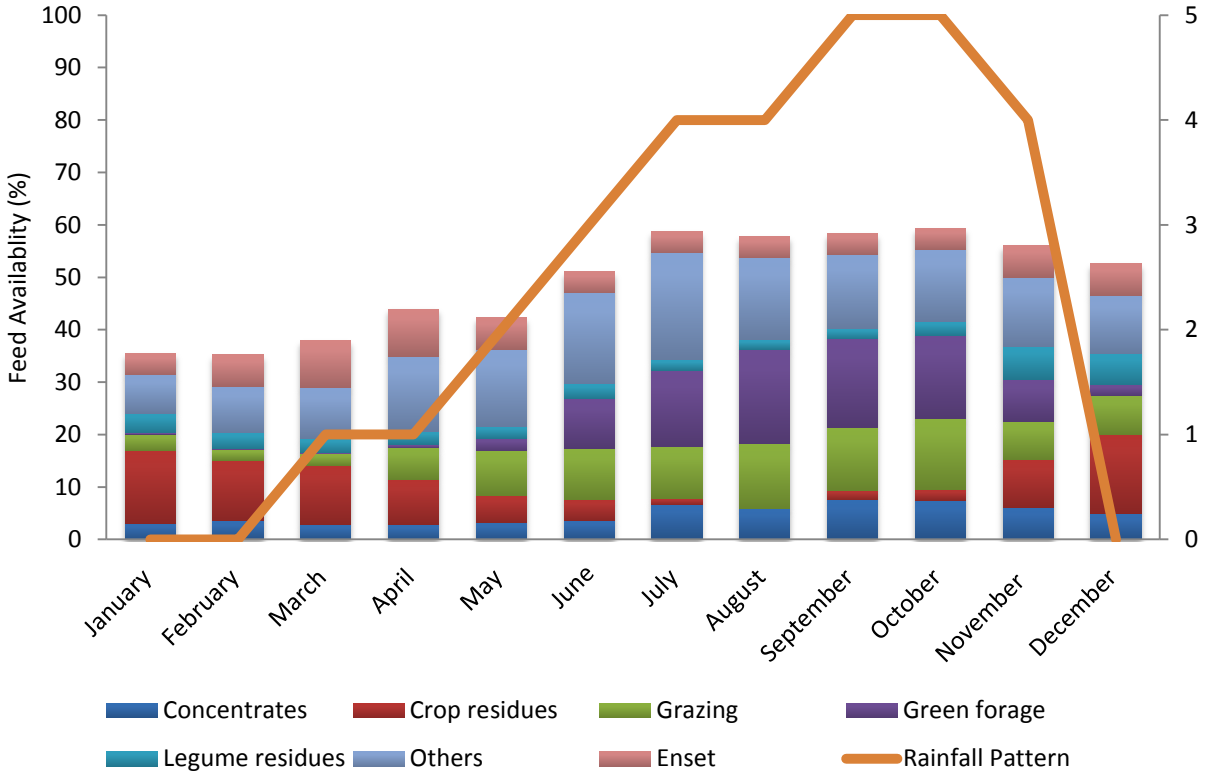


Figure 9: Seasonality of feed resources in Bekafa *kebele* in relation to the rainfall pattern

Livestock health management

In Bekafa *kebele*, farmers are not satisfied by the veterinary service because the animal health post is far from the majority of the community households because one veterinary service center serves at least three to four surrounding rural *kebeles*. Thus, some of the farmers in Bekafa *kebele* are forced to travel distances of longer than one hour to get the service at Marie site, the veterinary center. Farmers reported that they mostly use public veterinary service because of fair prices and good quality of drugs. Public veterinary services face supply problem of required drugs which then forces farmers to look for private services. Service cost varies between public (cheaper) and private ones (expensive). Farmers pay 3-10 birr ($0.15-0.5) and 25 birr ($1.25) for treating cattle in public and private vet service respectively. This varies depending on the type of disease and treatment required.

Breeding management

Farmers stated that there is shortage of improved livestock breed specially that of cattle. During the group discussion, farmers expressed their great interest to replace local low producing breeds of cattle with improved one if they would get proper breed improvement service (which currently is very poor). Both artificial insemination and bull services are not available in the *kebele*. Farmers take their cows to other neighboring sites such as Hamecho (up to 2 hours travel for return trip). Thirty to 40 birr ($1.5-2.0) is paid for one bull service. There are usually up to two repeat services.

Problems, issues and opportunities

Major problems faced by farmers in the *kebele* with reference to livestock production include feed shortage, improved breed shortage, financial shortage, knowledge gap (awareness problem) and poor animal health service. Farmers take different measures as a coping mechanism for some of the existing problems. Main problems, coping mechanisms and suggested solution for each study site have been listed in Table 4.

Table 4: Problems, coping mechanisms and suggested solutions in Bekafa *kebele*

Problems	Rank	Coping mechanism	Suggested solution by farmers
Financial shortage	**1**	**Search for other informal credit sources (friends and informal credit suppliers – "*arata*'').** **Become member of credit and saving cooperatives.** **Sale small animals (calf, sheep, chicken) and crop (wheat, potato, etc).**	**If appropriate credit service is arranged in such a way that anybody can get the required amount of money with fair interest rate.**
Feed shortage	**2**	**Use enset which otherwise was used for human food.** **Properly collect and conserve straw for bad seasons.** **Allocate small partition of cultivated land to naturally grow grass for grazing.** **Cultivate maize and oat for forage purpose.** **Purchasing feed like bran, '*atela*' and grass.**	**Provision of improved forage seeds/planting materials.** **Increase awareness of farmers on improved forage production systems through practical training**
Improved breed shortage	**3**	**Taking animals (cows) to the area where bull service is available.**	**Appropriate AI and/or bull service need to be arranged in a way that every farmer can get the service on the right time at the right place.**
Knowledge gap	**5**	**Sharing experience from other neighboring farmers.**	**There should be practical training and appropriate extension system with regard to livestock system.**
Lack of proper health service	**4**	**Travelling long distances for services.** **Use private vet services at expensive cost and with the risk of expired drugs.**	**Establish vet health post in the nearby area.** **Making available all necessary drugs.**

		Use traditional treatment (different medicinal plant leaf –eg Bisana leaf, crashed and mixed with water to drench case animal)	**Capacitating skill of experts and employing additional experts.**

Pair-wise comparison of problems was made with farmers in during group discussion in the target kebele so as to identify more important problems in rank order.

Table 5: Pair-wise comparison of problems in Bekafa kebele

Problem	Feed shortage (A)	Finance shortage (B)	Breed shortage (C)	Awareness problem (D)	Poor health service (E)
Feed shortage (A)					
Finance shortage (B)	B				
Breed shortage (C)	A	B			
Awareness problem (D)	A	B	C		
Poor health service (E)	A	B	C	E	
Total score	3	4	2	0	1
Rank	2	1	3	5	4

From the above pair-wise comparison tables, financial shortage is the top most and feed shortage is the second important problem in Bekafa kebele with reference to livestock system.

Potential interventions include: integration of improved grass and legume forages with other cropping and natural resource conservation activities, availing proper breed improvement service like AI, proper health service, appropriate input supply like forage seed/planting material relevant for the area and farming system, and proper credit service supplemented with strong awareness creation through different practical trainings are the potential intervention areas to improve the existing situation related to livestock production.

Conclusions

Farmers are willing to accept for change if they are equipped with technical and financial support. Therefore, it can be concluded that change can be brought about if different development and research organizations and concerned stakeholders intervene towards tackling the problems in line with suggestion given by farmers up on discussion. Appropriate forage technologies that fit the agro-ecologies and existing farming system need to be introduced to the area with the objective of improving feed availability and quality. Appropriate technology extension and knowledge transfer need to be employed in a way that can bring profitable and sustainable environmental friendly livestock production system in the area. Integrating different forage grasses and legumes with other farming system need to be given strong attention by concerned stakeholders.

Summary

Feed shortage is among the most important impediments for improved livestock production and productivity in the Bekafa *kebele*. Increasing population is causing increased demand for additional cultivated land. This in turn results in serious shortage of grazing land due to conversion of pasture lands to crop land. Majority of the farmers are raising local breeds of cattle which have poor production performance. Quality of feeds and feeding management, housing, breeding and health management employed by and provided for farmers are not quite enough to improve livestock production and productivity in the study area. Knowledge gap among farmers, poor input and credit supply and weak extension system with reference to livestock system are aggravating the problem.

The demand for livestock and their products is steadily increasing in Bekafa according to the farmers. Farmers realize the benefits of keeping livestock. However, both herd numbers and the production potential of livestock are decreasing due to feed shortage, breeding, health, management problem and capital shortage.

Appropriate supply of improved forage technology package, feeding system and feed management, provision of proper breeding, health and credit services are some of the potential interventions suggested by farmers in target study site during PRA group discussion. Therefore, cooperation of different development and research organization and integrating different forage technologies and livestock operations with other farming activities is expected to bring about improvement.